What influences PhD graduate trajectories during the degree : a research-based policy agenda

McAlpine, Lynn

2020-12

McAlpine , L , Castello , M & Pyhältö , K 2020 , ' What influences PhD graduate trajectories during the degree : a research-based policy agenda ' , Higher Education , vol. 80 , no. 6 , pp. 1011-1043 . https://doi.org/10.1007/s10734-019-00448-7

http://hdl.handle.net/10138/321725
https://doi.org/10.1007/s10734-019-00448-7

Higher Education (2020) 80:1011–1043
https://doi.org/10.1007/s10734-019-00448-7

What influences PhD graduate trajectories during the degree: a research-based policy agenda

Lynn McAlpine[1] · Montserrat Castello[2] · Kirsi Pyhaltö[3]

Published online: 28 October 2020

Abstract
During the past two decades, PhD graduate numbers have increased dramatically with graduates viewed by governments as a means to advance the knowledge economy and international competitiveness. Concurrently, universities have also invested in policies to monitor satisfaction, retention, and timely completion—and researchers have expanded the study of PhD experience. We, as such researchers, have increasingly received invitations from university decision-makers to present research evidence which might guide their doctoral programs. Their interest provoked us to do a qualitative systematized review of research on doctoral experience—seeking evidence of practices that influenced retention, satisfaction, and completion. The result contributes a synthesis of the critical research evidence that could be used to inform doctoral education policy. We also demonstrate the possibilities of such evidence by suggesting some potential recommendations, while recognizing that there is no direct relationship between research results and their transformation into particular institutional contexts in ways that enhance doctoral experience. We hope our initiative will be taken up and extended by other researchers, particularly the research gaps we note, so we can collectively support the use of research evidence to influence both doctoral policies and practices—with the goal to better prepare PhD researchers for their futures and better support their supervisors.

Keywords Doctoral programs · Policy · Research-based evidence · Qualitative systematized review

✉ Lynn McAlpine
Lynn.mcalpine@learning.ox.ac.uk

Montserrat Castello
montserratcb@blanquerna.url.edu

Kirsi Pyhaltö
kirsi.pyhalto@helsinki.fi

Extended author information available on the last page of the article

Context

Trajectories are built from the very beginning of the PhD (Mangematin 2000, 751)

During the past two decades, there has been a large increase in the number of PhD researchers (OECD 2016) as governments have increasingly construed PhD graduates as needed to advance the knowledge economy and international competitiveness (Hancock et al. 2015). Alongside this growth, universities have increasingly invested in policies that originate in a desire for (a) shorter times to completion and (b) graduates who are better prepared for work outside the academy (Auriol et al. 2012).

Concurrently, there has been a tremendous growth of research into doctoral education. We, as such researchers,[1] have been invited to give presentations to university decision-makers who are seeking research evidence to guide their thinking (European University Association 2016) in supporting PhD researchers[2] and supervisors. Among these individuals are pro vice chancellors, vice principals, and deans of postgraduate studies and their teams and similar individuals at the faculty (associate deans) and departmental (directors of graduate studies) levels. Their interest in the transformation of research evidence into policy potential provoked us to undertake this systematized review.

At the same time, the outcomes of any initiative to implement reform will be influenced by specific constraints and affordances (Andres et al. 2015). For instance, institutional histories vary considerably, including local departmental practices, and these need to be taken into consideration in transforming research evidence to the local context. Further, as Ball et al. (2012) have argued individuals take on more active or passive stances in different elements of their jobs in relation to different policies and their roles. As a result, responses from different stakeholders can vary from professional pragmatism through symbolic compliance and formal instrumentality to rational resignation (Teelken 2012). Thus, policy changes do not necessarily lead to the desired practices. In other words, there is no certainty that the results of any policy change will produce the hoped for effects.

Purpose

Our goal was to systematically review the doctoral research in order to synthesize the critical evidence that could inform doctoral programs, particularly enhance retention, satisfaction, and completion, and from this synthesis suggest possible policies to support PhD researchers, but also of benefit to supervisors, especially those starting out.[3] We chose these three factors since they have been frequent reference points in the past, both in research and institutional policy. An early concern was PhD researcher attrition (dropout) and retention: two sides of the same coin. Retention incorporates the notion of persistence; it refers to researchers remaining in their

[1] See https://www.researcher-identity.com regarding our European cross-national research on PhD and post-PhD researchers.

[2] We refer throughout this paper to PhD researchers rather than students (the more common English term) as we want to highlight the shift in expectations from undergraduate or Master's to the PhD: with the PhD researcher expected to be agentive in progressing his/her own research. As well, the term, "student," is not used in some countries; of course, in some places, PhD researcher could be understood as a PhD graduate.

[3] If you are an experienced researcher or manager in doctoral education, you may already have developed your own personal synthesis.

programs and, in some cases, remaining in their fields beyond graduation. Emerging from this focus on retention grew the interest in completion in various forms: first tracking time to completion and later timely completion against a standard. Satisfaction as regards aspects of the doctoral experience is a frequent tracking mechanism in understanding retention/persistence and progress to completion as there is plentiful evidence that satisfaction is linked to engagement in research and more timely completion. Accordingly, satisfaction can be considered as a central indicator of study progress and positive doctoral experience. Moreover, it provides a link to PhD researcher well-being in terms of study engagement. This is particularly important since reduced levels of well-being have been identified as a significant problem among PhD researchers, that is, a significant number of them experience high levels of distress, even burnout during their studies.

We hope this synthesis and our suggestions for policy implications will (a) provide a starting point for researchers to engage decision-makers in similar discussions and, (b) most importantly, encourage other researchers to review and expand on our work. After summarizing the literature reviews from 2001 onwards to highlight recurring themes over the years, we describe the method we used and then the evidence we draw on to generate possible policy implications.

What is the state of research on PhD education?

Over the past 15–20 years, there has been a dramatic growth in research on doctoral education. A series of reviews, each taking a somewhat different perspective, collectively provide a sense of the scope of this work: an account over time of more and less robust areas of research. You may note as you read that the three factors are mentioned: (lack of) completion (retention/attrition) and time to completion nearly always, with satisfaction to a somewhat lesser extent. Generally, the studies explore specific aspects or processes of the experience, e.g., supervisor–researcher relationship and writing.

A pioneer review, Golde (2001) summarized the research on doctoral education in the USA from 1990 to 2001. Issues pertinent at that time included the following: lengthy times to completion, lack of completion (characterized as attrition), retention, lack of funding leading to debt, and supervision including the extent to which supervisory workloads might influence the potential to be "mentors." A further theme was satisfaction as regards the decision to do the degree, the supervisor, and overall experience. Finally, the number of PhD graduates "produced," even then, was higher than the available academic positions, suggesting therefore the need to prepare graduates for other careers.

Later, Leonard et al. (2006) explored the research on doctoral education published in the UK in order to name gaps for future research. Just over half of the studies focused on the departmental and institutional work study context in terms of provision but without any systematic comparison across institutions. Close to half looked at the overall program satisfaction. Similar to Golde (2001), there was a concern in one-third of the studies with completion times and rates (and briefly retention), and employment patterns, but little systematic information on causes of lack of completion. They similarly noted the focus on supervision as well as new foci, peer support such as research teams, researcher-led support groups, and doctoral writing. They concluded that much of the research had ignored individuals outside the social sciences and that very little research had been done on researchers' perspectives, such as their views of the doctoral experience.

Driver (2006) was unusual in examining the literature in relation both to pedagogy and policy—likely due to his institutional role as a senior administrator. The review includes reports by national organizations of graduate education and guidebooks for researchers and supervisors. The core focus is completion as regards retention and progress towards completion. The literature is grouped as regards researchers, supervisors, and administrators. For each role, the common themes are noted; such themes for researchers include the following: (a) discuss expectations with supervisors (including non-program-based activities such as attendance at conferences, grant applications, research assistant (RA)/lab duties), (b) learn to manage time, establish goals, and follow deadlines, (c) initiate contact regularly with the supervisor, (d) learn to respect your supervisor's criticism, (e) recognize your supervisor may be busy, (f) have academic integrity and honesty, and (g) get involved in your department.

More recently, the reviews have burgeoned. John and Denicolo (2013) reviewed the literature on PhD experience in OECD countries (though with a UK emphasis) focusing on identifying gaps filled and remaining since Leonard et al. (2006). The review noted a large number of "how-to" books, reports on institutional workshops, and advice articles aimed at either the researcher or supervisor around the theme of improving aspects of this relationship. Research had grown on internationalization and the experience of international researchers. Also, researchers' accounts had increasingly been foregrounded, though with little inquiry into the differences in daily PhD events and practices. The authors suggested further investigation into researcher agency, the comparative specific experiences of doctoral researchers within and between institutions and countries, and inquiry into disciplines other than the social sciences (as in Leonard et al. 2006). They note an increase in attention to satisfaction, with variation as regards focus, e.g., supervision and overall experiences.

Vos (2013) reviewed the literature on dissertations, notably on a broad scale, including theses from the PhD, Master's, and undergraduate levels. The review is of note since the intent was to explore the pedagogical implications of the studies. Vos grouped the literature into six categories each accompanied by commentary and recommendations. As in earlier reviews, the following themes emerged: (a) researcher–supervisor relationship with satisfaction linked to different aspects of the relationship; (b) researcher diversity, cultural background, and prior preparation for undertaking a dissertation; and (c) researcher progress through the PhD process, including ways to improve researcher motivation. Other themes included (a) teaching and learning research methods and (b) issues related to plagiarism and academic dishonesty.

Vanstone et al. (2013) reviewed the literature on interdisciplinary doctoral supervision, given the increase in interdisciplinary PhDs. They argued that this integration of research fields could influence the (a) researcher–supervisor relationship, (b) process of forming and working with a supervisory committee, and (c) processes and outcomes of doctoral research. Their goal was to characterize the areas of research saturation and areas for future research. They reported that there is scant literature on the positive aspects of interdisciplinary research, given most research examines the potential challenges for researchers. The challenges were discussed directly or through suggestions for improvement. They concluded that while many claim that interdisciplinary work is growing at the PhD level, this assertion has still not been established on a national or international level. No reference was made to satisfaction, retention, or completion.

Similar to Driver (2006), Bengtsen (2014) focused on literature beyond published research papers, examining eight often-cited handbooks for supervisors. The rationale was that handbooks synthesize the research in a way accessible to supervisors, that is, from a pedagogical perspective. The review highlights the common themes across authors as well as their distinct

perspectives. Common themes include the following: (a) the entanglement of doctoral supervision within the institutional context; (b) enculturation within the specific disciplinary context, including tacit norms and values for good conduct; (c) academic craftsmanship including supporting the research project—especially given the more heterogeneous researcher population; (d) supporting and facilitating autonomy and emancipation; (e) the supervisor and researcher relationship in enhancing progress to completion; and (f) the supervisory dialogue which is related to (g) building an open and trusting dialogue. Perhaps, given the nature of the review, good supervisory support is referenced as a means to contribute to completion, with no reference to satisfaction or completion.

This characterization of the prior research on PhD experience is consistent with our view and makes clear the ways in which retention, completion, and satisfaction have been touchstones in examining doctoral experience. Overall, while one might argue there has been some progress as regards several issues reported in the reviews, the historical intractability of the concerns is striking, such as researcher–supervisor relationship, disciplinary-departmental issues, or the institutional context. From our perspective, what is of most concern is the silence since 2006 on the "surplus" of PhD graduates and the failure to prepare graduates for non-academic post-PhD careers; such research is essential if we truly want to better prepare PhD researchers for their futures.

We would argue that the initial focus on researcher–supervisor relationship as critical to researcher success likely emerges from the historical nature of relatively unstructured PhDs with little sense of a program or a cohort. However, while the supervisor remains important, our view is that the role of the supervisor is now more institutionally structured and so may not play quite as powerful a role as previously. Specifically, (a) PhD programs are increasingly standardized including multiple forms of structured learning (e.g., modules, workshops, writing centers, and career services); (b) there is more institutional accountability (e.g., greater monitoring of PhD progress, more formal assessment procedures); and (c) other academics are increasingly involved in the support of doctoral progress, e.g., academics other than the supervisor involved in assessment and feedback.

Finally, we suggest future research should be directed at (a) a growing policy initiative, co-supervision; (b) related alternate models of supervision, such as non-academic co-supervisors; and (c) the impact of new technologies on doctoral and supervisory practices (McAlpine 2017). As well, while there is much reported on thesis writing, there is little on other genres of writing and publishing or on reading. Finally, the literature generally reports the PhD researcher as the object of attention which facilitates thinking about policy implications since it highlights departmental and institutional structures that might better support PhD researchers. However, this perspective pays little attention to the researcher as an active agent in the PhD process, an issue we address shortly.

Method

Framing what affects PhD graduate trajectories during the degree

In approaching this analysis, we took a "nested contexts" perspective (McAlpine and Norton 2006), locating the influences on PhD experience in relation to embedded contexts. The framework integrated the previous research on doctoral education and remains useful today in differentiating the influences and interactions of different players in the process. The

researcher and supervisor relationship rests at the center—nowadays sometimes embedded in research teams.[4] The supervisory relationship is situated within the *local departmental–disciplinary context* which integrates (and interprets) both local practices emerging from institutional policies and disciplinary assumptions (which tend to be global) about disciplinary modes of research. The department is situated within the *institutional context*; this context creates the policies, the affordances, and constraints that influence the practices in departments related to, for instance, selection/admission, PhD funding, and program requirements. Given the interaction between the departmental and institutional contexts, we treat them together in our analysis. Finally, moving outward again, the *societal–international* context includes elements such as policies, both national (research funding) and international (global competitiveness), as well as economic trends (the strength of different labor sectors) which influence the other contexts. While this final context can act as a powerful influence on PhD programs, for this paper, we set it aside, given both a lack of research evidence and space limitations.

Approach

We chose to undertake a systematized review (Grant and Booth 2009). Such a review includes the same elements of a systematic review but not necessarily the same processes within each element: (a) comprehensive search; (b) assessment of the studies; (c) synthesis of the findings; and (d) analysis—what is known, recommendations for practice, what remains unknown, uncertainty around findings, and recommendations for future research.

We (a) set criteria for inclusion; (b) generated and integrated lists of pertinent studies; (c) analyzed them to generate pertinent research evidence in relation to completion, retention, and satisfaction—as well as gaps in research—and finally (d) generated potential policy implications.

Setting inclusion criteria Our starting point was that the studies of most use as regards institutional policy implications would be those that linked PhD experiences and practices to evidence of doctoral success. In other words, from an institutional perspective, monitoring and assessment procedures are linked to ensuring researchers are making satisfactory progress and completing in a timely fashion (e.g., University of Reading 2013). Thus, we set the following criteria for inclusion in our analysis: (a) timely through to lack of completion, (b) low through to enhanced retention, and (c) satisfaction (engagement in research, reduced burnout, and more timely completion) through to dissatisfaction, with the reverse effects (burnout, exhaustion, and lack of completion risk).

Generating and integrating lists While we are all experienced researchers in the area, we each have different scholarly and methodological roots. We took advantage of this by each reviewing our individual databases of doctoral studies to generate a list related to completion, retention, and satisfaction since 2000, since, as noted earlier, the past two decades have seen a growth in research on doctoral education. We collated our lists, and then to ensure we had not overlooked research evidence, we re-read the literature reviews from the same period (described previously) and added any studies that provided empirical evidence. Finally, to ensure

[4] Research teams are often, but not always, embedded in departmental contexts, although cross-university research teams have become more common. In this paper, research teams are addressed in the section, departmental–faculty–institutional contexts.

that we had generated a comprehensive set of studies, we characterized each study as to (a) its disciplinary cluster, (b) its research methods (quantitative, mixed, and qualitative), and (c) the geographical location by continent in which the study took place—Europe (including the UK), Australasia, and North America. This information is noted immediately after the relevant citations in the Reference list. As well, Table 1 includes this information along with keywords to show the focus of the study and number of participants in the study. You will note that there is a relatively equal distribution of studies across continents, a relatively equal mix of qualitative or quantitative methods with a considerably smaller number of mixed methods. Social sciences are more prevalent than other disciplinary clusters (as we know); still, STEM and humanities studies are represented relatively robustly.

Analysis We then reviewed these studies. Our goal was to verify they did indeed address in meaningful ways features of doctoral experience that addressed completion, retention, and satisfaction.

Next, we grouped the citations thematically, noting any contrary evidence, in relation to the nested contexts of interest: the PhD researcher–supervisor and the departmental-institutional contexts. In many cases, there were a number of studies supporting a particular policy implication, e.g., writing support, which represented both different methods and geographical locations. However, given space limitations, we have included no more than two references for a given feature of PhD experience. These were chosen based on recency and robustness of the study.

Generating policy implications Based on the themes, we generated possible policy implications, while recognizing the following limitations. These studies were conducted in different countries with different national policies and pressures. Further, circumstances in the particular university settings must indeed have varied as do the circumstances in any university drawing on these results to inform policy. Thus, our policy implications must be viewed as suggested directions for a policy that need adjusting and embedding in local circumstances.

Researcher–supervisor interaction

We begin by highlighting specific personal practices that promote satisfaction and progress and end with policy implications, which can be implemented at departmental, faculty, or university levels.

What promotes satisfaction, retention, and completion

A range of studies suggest that specific practices by the PhD researcher and the supervisor can contribute to enhanced time-to-candidacy, degree completion, doctoral researcher well-being, and satisfaction with the overall doctoral experience (Ives and Rowley 2005; Pyhältö et al. 2015). We have grouped this evidence as follows: the researcher, the supervisor, and researcher–supervisor relations.

PhD researcher We begin with PhD researchers since, as we noted earlier, their agency has been largely absent from much of the research, yet the PhD researcher is the central player in the PhD journey—the one with the most invested.

Table 1 Characteristics of cited studies

Reference	Keywords	Method	Number of participants	Discipline	Continent
Aitchison, C., Catterall, J., Ross, P., & Burgin, S. (2012). 'Tough love and tears': Learning doctoral writing in the sciences. *Higher Education Research and Development*, 31(4), 435–447.	DOCTORAL pedagogies DOCTORAL supervision DOCTORAL writing SCIENTIFIC writing	MX	65 QN 28 QL	SS + STEM + H	A
Ampaw, F., & Jaeger, A. (2012). Completing the three stages of doctoral education: An event history analysis. *Research in Higher Education*, 53, 640–660.	DOCTORAL students FINANCE SCHOOL dropout prevention GRADUATE students STUDENT financial aid LABOR market SCHOLARSHIPS -- United States LABOR & education ECONOMIC conditions	QN	2068	SS + H	NA
Badenhorst, C., Moloney, C., Rosales, J., Dyer, J., & Ru, L. (2014). Beyond deficit: graduate student research-writing pedagogies. *Teaching in Higher Education*, 20(1), 1–11.	ACADEMIC literacies GRADUATE research writing ACADEMIC writing RESEARCH conceptualization discourse	QL	1	SS + STEM	NA
Barnes, B., Williams, E., & Stassen, M. (2012). Dissecting doctoral advising: A comparison of researchers' experiences across disciplines. *Journal of Further and Higher Education*, 36(3), 309–331.	DOCTORAL students DOCTORAL advisors FACULTY advisors DOCTORAL degree APPRENTICESHIP programs TEACHER role COLLEGE curriculum COUNSELING in higher education TRAINING	QN	870	SS + STEM + H	NA
Bergeron, D., Ostroff, C., Schroeder, T., & Block, C. (2014). The dual effects of organizational citizenship behaviour: Relationships to research productivity and career outcomes in academe. *Human Performance*, 27(2), 99–128.	-	QN	614	SS	I
	DOCTORAL education	QN	724	SS	E

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
Castelló, M., Pardo, M., Sala-Bubaré, A. & Suñe, N. (2017). Why do students consider to drop out of doctoral degrees? Institutional and personal factors. *Higher Education*, 1–16, doi: https://doi.org/10.1007/s10734-016-0106-9.	DROPPING-out PERSONAL and institutional factors RESEARCHER education SOCIALIZATION				
Cluett, L. and Skene, J. (2006). Improving the postgraduate coursework student experience: barriers and the role of institution. *Proceedings of the AUQF 2006: Quality Outcomes and Diversity*, Perth, Australia, 5–7 July 2006, 62–67. Available from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.145.5455&rep=rep1&type=pdf#pa%20ge=76.	-	QN	182	SS + STEM + H	A
Donald, J., Saroyan, A., & Denison, D. B. (1995). Graduate researcher supervision policies and procedures: a case study of issues and factors affecting graduate study. *The Canadian Journal of Higher Education*, 25(3), 71–92.	–	QN	–	SS + H	NA
Driver, J. (2006). SFU reviews graduate supervision. *Gradspeak*, 2(1), 1–4.	–	QL	Review	SS	NA
Ehrenberg, R., Jakubson G., Groen, J., So, E., & Price, J. (2006). Inside the black box of doctoral education: What program characteristics influence doctoral students' attrition and graduation probabilities? *Educational Evaluation & Policy Analysis*, 29(2), 134–150.	ATTRITION rates COMPLETION rates PhD programs	QN	13,552	STEM + SS + H	NA
Forret, M. & Dougherty, T. (2004). Networking behaviors and career outcomes: differences for men and women? *Journal of Organizational Behaviour*, 25 (3), 419–437.	MEN WORKING women MENTORING COMMUNITY life HUMAN behavior SOCIOECONOMICS SOCIAL capital TURBANS REGRESSION analysis	QN	418	SS + STEM	NA
Gardner, S. (2009). Researcher and faculty attributions of attrition in high and low-completing doctoral programs. *Higher Education*, 58, 97–112.	ATTRIBUTION theory ATTRITION DOCTORAL students	QL	94	SS + STEM	NA
	GRADUATE Students	QL	60	SS + STEM	NA

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
Gardner, S. (2010). Contrasting the socialization experiences of doctoral researchers in high-and low-completing departments: A qualitative analysis of disciplinary contexts at one institution. *The Journal of Higher Education*, 81(1), 61–81.	SOCIALIZATION DOCTORAL Programs STUDENT Attrition GRADUATION Rate STUDENT Experience ACADEMIC Persistence SCHOOL Culture ENVIRONMENTAL Influences INTELLECTUAL Disciplines SOCIAL Influences INDEPENDENT Study STUDENT Attitudes INTERVIEWS Adjustment (to environment)				
Gittings, G., Bergman, M., Shuck, B., & Rose, K. (2018). The Impact of Student Attributes and Program Characteristics on Doctoral Degree Completion. *New Horizons in Adult Education and Human Resource Development*, *30*(3), 3–22.	DOCTORAL students ADULT learners PERSISTENCE EDUCATIONAL DOCTORAL degree completion	QN	275	DIS	NA
Golde, C. (2005). The role of the department and discipline in doctoral researcher attrition: Lessons from four departments. *Journal of Higher Education*, 76(6), 669–700.	STUDENT attrition GRADUATE students DOCTORAL programs GRADUATE education HIGHER education ACADEMIC departments (Universities & colleges) -- Evaluation SCHOOL dropouts COLLEGE dropouts	QL	58	SS + STEM	NA
Golde, C., & Dore, T. (2001). *At cross purposes: What the experiences of today's doctoral researchers reveal about doctoral education*. Philadelphia	–	QN	4114	SS + STEM + H	NA
Goller, M., & Harteis, M. (2013). Employing agency in academic settings: Doctoral students shaping their own experiences. In C. Harteis et al. (Eds.),	FACULTY Member DOCTORAL Student	QL	10	STEM	E

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
Discourses on Professional Learning: On the Boundary Between Learning and Working (pp. 189–210). Dordrecht Springer.	ACADEMIC Success SUCCESS Criterion AGENTIC Behaviour				
González-Ocampo, G., & Castelló, M. (2018). Writing in doctoral programs: examining supervisors' perspectives. *Higher Education*, 76(3), 387–401.	DOCTORAL education SUPERVISION DOCTORAL writing SUPERVISORY writing support	QL	61	SS + H	E
Harman, G. (2002). Producing PhD graduates in Australia for the knowledge economy. *Higher Education Research & Development*, 21(2), 179–190.	-	MX	1537 QN 100 QL	SS	A
Heath, T. (2002). A quantitative analysis of PhD researchers' views of supervision. *Higher Education Research & Development*, 21(1), 41–53.	–	QN	355	SS	A
Holbrook, A., Shaw, K., Scevak, J., Bourke, S., Cantwell, R., & Budd, J. (2014). PhD candidate expectations: Exploring mismatch with experience. *International Journal of Doctoral Studies*, 9, 329–346.	DOCTORAL expectations MISMATCHED expectations DOCTORAL candidate experience DOCTORAL candidature DOCTORAL satisfaction RESEARCH education	MX	1374 QN 104 QL	SS + H	A
Holdaway, E., Delbois, C., & Winchester, I. (1995). Supervision of graduate researchers. *The Canadian Journal of Higher Education*, 25(3), 1–29.	–	QN	727	SS + H	NA
Humphrey et al. (2011). The Impact of Research Training and Research Codes of Practice on Submission of Doctoral Degrees: An Exploratory Cohort Study. *Higher Education Quarterly*, 66(1), 47–64.	DOCTORAL degree COHORT analysis ACADEMIC degrees CLASSICAL education	QN	87	SS + STEM	E
Hyun, J., Quinn,B., Madon, T., & Lustig, S. (2006). Graduate researchers mental health: Needs assessment and utilization of counselling services. *Journal of College Researcher Development*, 47(3), 247–266.	NEEDS Assessment GRADUATE Students DEPRESSION (Psychology) COUNSELLING Services MENTAL Health ANXIETY MEASUREMENT Techniques WELL Being	QN	3121	SS + STEM + H	NA

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
	FACULTY Advisers STUDENT Surveys GENDER Differences RACE ETHNICITY CORRELATION BEHAVIOURAL Science RESEARCH CASE Studies				
Ives, G., & Rowley, G. (2005). Supervisor selection or allocation and continuity of supervision: PhD researcher' progress and outcomes. *Studies in Higher Education*, 30(5), 535–555.	SUPERVISORS STUDENTS DOCTOR of philosophy degree SUPERVISION of GRADUATE students ACADEMIC achievement EDUCATION: Administration of Education Programs All Other Miscellaneous Schools and Instruction Educational Support Services	QL	21	SS	A
Jackson, D., & Michelson, G. (2015). Factors influencing the employment of Australian PhD graduates. *Studies in Higher Education*, 40(9), 1660–1678.	PHD GRADUATEs JOB attainment EMPLOYMENT factors AUSTRALIA EMPLOYABILITY	QN	5942	SS+H	A
Jairam, D., & Kahl Jr., D. (2012). Navigating the doctoral experience: The role of social support in successful degree completion. *International Journal of Doctoral Studies*, 7, 311–329.	DOCTORAL education DOCTORAL experience SOCIAL support STRESS-buffer hypothesis	QL	31	SS + STEM + H	NA
Kamler, B. (2008). Rethinking doctoral publication practices: Writing from and beyond the thesis. *Studies in Higher Education*, 33(3), 283–294.	ACADEMIC dissertations SCHOLARLY publishing DOCTORAL students	QL	24	SS + H	A

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
	MENTORING in education ACADEMIC discourse -- Study & teaching AUTHORSHIP collaboration				
Lee, A. (2013). New development: Are our doctoral programmes doing what we think they are? *Public Money and Management*, 33(2), 119–122	DOCTORAL research ETHICS INTERNATIONALIZATION QUALITY assurance RESEARCH objectives	QL	Review	SS + H	E
Lee, A. and Boud, D. (2003). Writing groups, change and academic identity: research development as local practice. *Studies in Higher Education*, 28, 2, 187–200	EMPLOYEE training RESEARCH UNIVERSITIES & colleges	QL	25	SS + H	A
Lee, A., & Murray, R. (2015). Supervising writing: Helping postgraduate researchers develop as researchers. *Innovations in Education and Teaching International*, 52(5), 558–570.	ACADEMIC development CONCEPTUAL model ENQUIRY-based learning DOCTORAL education SUPERVISION WRITING	QL	12	STEM + H	E
Lovitts, B., & Nelson, C. (2006). The hidden crisis in graduate education: Attrition from PhD programs. *Academe*, 86(6), 44–50.	GRADUATE studies APPLICATIONS COLLEGE students	QN	816	SS + H	NA
Maher, M., & Barnes, B. (2010). Assessing doctoral applicants' readiness for doctoral-level work. *Assessment today*, 22(5), 8–10	LEARNING strategies DOCTORAL programs HIGHER education administration	MX	15 QN & QL	SS + STEM + H	NA
Maher, M., & Say, B. (2016). Doctoral supervisors as learners and teachers of disciplinary writing. To appear in C. Guerin & C. Badenhorst (Eds.), *Post/graduate Writing Pedagogies and Research Literacies in the 21st Century*. London: Emerald.	DISCIPLINARY writing COGNITIVE apprenticeship WRITING for publication DOCTORAL writing pedagogy	QL	43	STEM	NA
Main, J. (2014). Gender homophily, PhD completion, and time to degree in the humanities and humanistic social sciences. *Review of Higher Education*, 37(3), 349–375.	TIME to Degree ACADEMIC Persistence GENDER Issues HUMANITIES	QN	7834	SS + H	NA

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
	SOCIAL Sciences DOCTORAL Degrees DOCTORAL Dissertations DEGREE Requirements STUDENT Financial Aid STUDENT Experience ACADEMIC Advising FACULTY Advisers TEACHER-Student Relationship INTERPERSONAL communication OUTCOMES of Education FEMALES MENTORS REGRESSION (Statistics) EDUCATIONAL Attainment LEAST Squares Statistics TEACHER Attitudes INTERPERSONAL Relationship				
McAlpine, L. (2013). Doctoral supervision: Not an individual but a collective institutional responsibility. *Infanci y Aprendizaje*, 36 (3), 259–280.	DOCTORAL learning as workplace learning SUPERVISION as pedagogy COLLECTIVE institutional responsibility	QL	100	SS + STEM	NA and E
McAlpine, L., & Amundsen, C. (2018). *Identity-trajectories: Ways of understanding post-PhD career choices*. Basingstoke: Palgrave MacMillan.	–	QL	100	SS + STEM	NA and E
McAlpine, L., & Amundsen, C. (2016). *Post-PhD Career Trajectories: Intentions, Decision-Making and Life Aspirations*. Basingstoke: Palgrave Pivot.	–	QL	48	SS + STEM	NA and E
McAlpine, L., Paulson, J., Gonsalves, A., & Jazvac-Martek, M. (2012). 'Untold' doctoral stories in the social sciences: Can we move beyond cultural narratives of neglect? *Higher Education Research and Development*, 31(4), 511–523.	DOCTORAL education DOCTORAL pedagogies STUDENT agency	QL	24	SS + H	I

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
McAlpine, L., & Norton, J. (2006). Reframing our approach to doctoral programs: A learning perspective. *Higher Education Research and Development*, 25(1), 3–17.	–	QL	Review	DIS	I
McGrail, M., Rickard, C., & Jones, R. (2006). Publish or perish: A systematic review of interventions to increase academic publication rates. *Higher Education and Research Development*, 25(1), 19–35.	–	QL	Review	SS	A
Nyhagen, G., & Baschung, L. (2013). New organizational structures and the transformation of academic work. *Higher Education*, 4, 409–423.	1. FUNDING 2. UNIVERSITIES 3. INTERDISCIPLINARY research 4. EDUCATIONAL research 5. DOCTORAL students 6. ACADEMIC education 7. HIGHER education 8. COLLEGE instruction 9. UNIVERSITY administration ACADEMIC work RESERACH centers DOCTORAL schools SPECIALIZATION COLLECTIVIZATION	QL	3 cases (doctoral schools)	SS	E
Olmos-Lopez, P., & Sunderland, J. (2016). Doctoral supervisors' and students' responses to co-supervision. *Journal of Further and Higher Education*, 41(6), 727–740.	CO-SUPERVISION DOCTORAL education FEEDBACK JOINT supervision PHD STUDENTs SUPERVISION THESIS writing	QL	44	SS + H	E
O'Meara, K., Jaeger, A., Eliason, J., Grantham, A., Cowdery, K., Mitchall, A., & Zhang, K. (2014). By design: How departments influence graduate researcher agency in career advancement. *International Journal of Doctoral Studies*, 9, 155–179.	AGENCY DOCTORAL students STEM CAREER advancement DEPARTMENT influences	MX	884 QN 61 QL	SS + H	NA

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
	CAREER paths WORK environments SKILLS RESOURCES NETWORKING MENTORING GUIDANCE				
Paré, A. (2011). Speaking of writing: Supervisory feedback and the dissertation. In L. McAlpine & C. Amundsen (Eds.), *Doctoral education: Research-based strategies for doctoral researchers, supervisors and administrators* (pp. 59–74). Dordrecht: Springer.	DOCTORAL Student ACADEMIC Writing DISCOURSE Community EXTERNAL Examiner SUPERVISORY Session	QL	± 15	SS	NA
Paré, A., Starke-Meyerring, D., & McAlpine, L. (2011). Knowledge and identity work in the supervision of doctoral researcher writing: Shaping rhetorical subjects. In D. Starke-Meyerring, A. Paré, N. Artemeva, M. Horne, & L. Yousoubova (Eds.). *Writing in Knowledge Societies* (pp. 215–236). Fort Collins: The WAC Clearinghouse and Parlor Press.	-	QL	± 15	SS	NA
Pearson, M. (1996). Professionalizing PhD education to enhance the quality of the researcher experience. *Higher Education*, 32, 303–320.	PROFESSIONAL Education PROFESSIONAL Practice ACADEMIC Community STUDENT Experience RESEARCH Training	MX	669 QN 38 QL	SS + STEM + H	A
Peltonen J, Veikkaila J, Haverinen K, Rautio P & Pyhältö K. 2017. Interrelations between supervisory researcher community support experiences and risk factors among doctoral students. *International Journal of Doctoral Studies*, 12(1), 157–173.	DOCTORAL education SUPERVISION SUPERVISORY activities BURNOUT	QN	248	SS + STEM + H	E
Pilbeam, C., & Denyer, D. (2009). Lone scholar or community member? The role of student networks in education in a UK management school. *Studies in Higher Education, 34*(3), 301–318.	–	QN	73	SS	E
Platow, M. (2012). PhD experience and subsequent outcomes: A look at self-perceptions of acquired graduate attributes and supervisor support. *Studies in Higher Education*, 37(1), 103–118.	GRADUATE education DOCTORAL students EMPLOYMENT EDUCATIONAL productivity	QN	1258	SS + STEM	A

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
	QUANTITATIVE research DOCTORAL degree SELF-perception				
Pole, C. (1998). Joint supervision and the PhD: Safety net or panacea? *Assessment and Evaluation in Higher Education*, 23(3), 259–271.	GRADUATE education SUPERVISION of graduate students	QL	300	SS + STEM	E
Pyhältö, K., & Keskinen, J. (2012). Doctoral Students' Sense of Relational Agency in Their Scholarly Communities. *International Journal of Higher Education*, 1(2), 136–149. https://doi.org/10.5430/ijhe.v1n2p136	RELATIONAL agency DOCTORAL student DOCTORAL education SCHOLARLY community	QN	669	SS + STEM + H	E
Pyhältö, K., McAlpine, L., Peltonen, J., & Castello, M., (2017). How does social support contribute to engaging Post-PhD experience? *European Journal of Higher Education*. 17 (4), 373–387. https://doi.org/10.1080/21568235.2017.1348239	SOCIAL support SUPERVISION RESEARCHER community POST-DOCTORAL students BURNOUT ENGAGEMENT ABANDONMENT	QN	282	SS + STEM	E
Pyhältö, K., Stubb, J., & Lonka, K. (2009). Developing scholarly communities as learning environments for doctoral students. *International Journal for Academic Development*, 14, 221–232.	DOCTORAL education SCHOLARLY community DOCTORAL students' perceptions about their learning environment STRESS	QN	602	SS + H	E
Pyhältö et al. (2015). Fit matters in the supervisory relationship: Doctoral students' and supervisors' perceptions about supervisory activities. *Innovations in Education and Teaching International*, 52(1), 4–16.	COLLEGE teacher STUDENT relationships DOCTORAL students FACULTY advisors SUPERVISION ROLE satisfaction RESILIENCE (Personality trait) ADULTS HIGHER education ATTITUDES	QN	1615	SS	E

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
Sala-Bubaré, A., & Castelló, M. (2016). Exploring the relationship between doctoral students' experiences and research community positioning. *Studies in Continuing Education*, 1–19. https://doi.org/10.1080/0158037X.2016.1216832.	DOCTORAL students DOCTORAL experiences SOCIALIZATION RESEARCH community DOCTORAL journey	QL	4	SS	E
Sala-Bubaré, A., Peltonen, J., Pyhältö, K., & Castelló, M. (2018). Doctoral students' research writing perceptions profiles: A cross-national study. *International Journal of Doctoral Studies*, 13, 327–345.	DOCTORAL candidates DOCTORAL writing WRITING perceptions SOCIAL support RESEARCH writing CROSS-national study	QN	1463	SS + STEM + H	E
Sauermann, H., & Roach, M. (2012). Science PhD career preferences: Levels, changes and advisor encouragement. *PloS ONE*, 7(5), e36307.	DOCTOR of philosophy degree SCIENTISTS -- United States COLLEGE students JOB applications LABOR market	QN	4109	SS	NA
Scaffidi, A., & Berman, J. (2011), A positive postdoctoral experience is related to quality supervision and career mentoring, collaborations, networking and a nurturing research environment. *Higher Education*, 62, 685–698.	POSTDOCS MENTORING COLLABORATIONS NETWORKING RESEARCH environment	QN	204	SS + STEM	A
Schmidt, M., & Hansson, E. (2018) Doctoral students' well-being: A literature review, International *Journal of Qualitative Studies on Health and Well--being*, *13*(1), DOI: https://doi.org/10.1080/17482631.2018.1508171.	DOCTORAL student PHD student WELL-BEING REVIEW SWOT	QN	Review	DIS	I
Shin, J., Kim, S., Kim, E., & Lim, H. (2018). Doctoral students' satisfaction in a research-focused Korean university: Socio-environmental and motivational factors. *Asia Pacific Education Review*, *19*, 159–168.	DOCTORAL education PROGRAM satisfaction SOCIALIZATION MOTIVATION KOREA	QN	418	DIS	A
	POST-GRADUATE SUPERVISION CO-SUPERVISION	QL	4	SS + H	A

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
Spooner-Lane, R., Henderson, D., Price, R., & Hill, G. (2007). Practice to theory: Co-supervision stories. *The International Journal of Research Supervision*, 1(1), 39–51.					
Stubb, J., Pyhältö, K., & Lonka, K. (2011). Balancing between inspiration and exhaustion? Ph.D. Students' Experienced Socio-Psychological Well-Being. *Studies in Continuing Education*, 33(1), 33–50. https://doi.org/10.1080/0158037X.2010.515572	DOCTORAL education SCHOLARLY community SPECIAL issue WELL-being	MX	669 QN 383 QL	STEM	E
Sundstrom, C. J. (2014). The graduate writing program at the University of Kansas: An inter-disciplinary, rhetorical genre-based approach to developing professional identities. In *Composition Forum* (Vol. 29). Association of Teachers of Advanced Composition. https://files.eric.ed.gov/fulltext/EJ1022020.pdf	PROFESSIONAL Identity GRADUATE Study WRITING Instruction INTERDISCIPLINARY Approach RHETORICAL Invention EDUCATIONAL Needs EDUCATIONAL History COURSE Descriptions WRITING Workshops PARTICIPANT Characteristics BARRIERS HIDDEN Curriculum CULTURAL Context PROGRAM Administration IMPROVEMENT Programs SUCCESS COLLEGE Programs	QL	Institutional case study	SS + STEM	NA
Sverdlik, A., Hall, N., McAlpine, L., & Hubbard. K. (2018). The PhD Experience: A Review of the Factors Influencing Doctoral Students' Completion, Achievement, and Well-Being. *International Journal of Doctoral Studies*. 13, 361–388.	DOCTORAL education DOCTORAL well-being HIGHER education GRADUATE education DOCTORAL achievement	QN, QL, MX	Review	DIS	I
Tardy, C. M. (2005). Expressions of disciplinarity and individuality in a multimodal genre. *Computers and Composition*, 22(3), 319–336.	GENRE IDENTITY MULTIMODALITY	QL	4	SS + STEM + H	NA

Table 1 (continued)

Reference	Keywords	Method	Number of participants	Discipline	Continent
	PRESENTATION slides SECOND language writing				
Thiry, H., Laursen, S., & Loshbaugh, H. (2015). "How do I get from here to there?" An examination of PhD science researchers' career preparation and decision making. *International Journal of Doctoral Studies*, 10, 237–256.	PH.D. STUDENTS CAREER preparation DECISION-making processes DOCTORAL students SCIENCE students	QL	104	SS + H	NA
West, K. (2012). Formative evaluation of the transition to postgraduate study for counselling and psychotherapy training: students' perceptions of assignments and academic writing. *Counselling and Psychotherapy Research: Linking Research with Practice*, 12(2), 128–135.	COUNSELLING EVALUATION POSTGRADUATE PSYCHOTHERAPY STUDENT feedback TRANSITION	QN	27	SS + STEM	E
Woolhouse, M. (2002). Supervising dissertation projects: Expectations of supervisors and students. *Innovations in Education and Teaching International*, 39(2), 137–144.	ACTION research TEACHER training	QL	2	SS + H	E
Zhao, C., Golde, C., & McCormick, A. (2007). More than a signature: How advisor choice and advisor behaviour affect researcher satisfaction. *Journal of Further and Higher Education*, 31(3), 263–281.	GRADUATE education ACADEMIC dissertations DOCTOR of arts degree DOCTORAL programs GRADUATE students TEACHER-student relationships HIGHER education FACTOR analysis UNITED States COLLEGES, Universities, and Professional Schools	QN	4010	SS + H	NA

Methods: mixed = MX, quantitative = QN, qualitative = QL (reviews included here)

Discipline: all disciplines = DIS, specific disciplines = STEM (science, technology, engineering, and mathematics), social sciences (SS), humanities (H), and other (O)

Continent: A = Australasia, E = Europe including UK, NA = North America, I = international

1. Involved in supervisor selection: PhD researchers are often assigned supervisors on the basis of supervisor availability. Yet, since PhD researchers seek expertise and/or supervisor interest in them (Barnes et al. 2012), being involved in supervisor selection is a positive experience (Ives and Rowley 2005), related to good progress and being satisfied (see also *researcher–supervisor relations*). In contrast, being assigned a supervisor leads to less positive outcomes than choosing a supervisor (Barnes et al. 2012).
2. Expectations met: Individuals applying for PhDs hold a range of expectations of the nature of the learning expected. Not surprisingly, a match between anticipated expectations about both learning and doing research and the actual experience enhances satisfaction and completion (Holbrook et al. 2014)—whereas the opposite leads individuals to feel uncertain and dissatisfied with their fit for the PhD. In a similar fashion, the knowledge of what is expected of a PhD degree is lower for non-completers and higher for completers (Lovitts and Nelson 2006). (See #12, *departmental leadership* for more related to this.)
3. Taking ownership of the degree: PhD researchers vary in the extent to which they feel and act as agents (O'Meara et al. 2014), and studies have shown that variation in researcher agency during the degree has long-term positive and negative implications (McAlpine and Amundsen 2018). In a similar vein, only those researchers displaying an awareness of their own coping strategies and perceiving themselves as agents in their doctoral trajectory are able to engage effectively in overcoming supervision-related problems (González-Ocampo and Castelló 2018). Further, doctoral researchers applying active strategies in their researcher community suffer less anxiety, lack of interest in their studies, and entertain a lower risk of study abandonment (Pyhältö and Keskinen 2012). Lastly, variation in PhD researcher agency throughout the degree, e.g., choosing or not to publish during the degree, led to long-term differences in satisfaction, completion, and career success (McAlpine and Amundsen 2016, 2018). As well, feelings of lack of agency, i.e., no specific strategies to develop career knowledge, can contribute to apathy and anxiety (Thiry et al. 2015).
4. Personal and academic peer networks: This refers to the ability to develop and manage relationships with others who have the potential to support careers (Forret and Dougherty 2004) and to effectively engage and collaborate with others to achieve goals (Pilbeam and Denyer 2009). Developing and using extensive personal and academic peer networks is highly related to persistence, motivation, production, and professional success (Goller and Harteis 2013). Further, investing in building a network of support has long-term effects; it nearly doubles one's chances of immediate employment within 12 months of graduation (Jackson and Michelson 2015). At the same time, it appears that in any cohort, only a minority of PhD researchers perceive themselves as active agents as regards developing their networks (Pyhältö and Keskinen 2012).

Supervisor We know that supervision has an impact as regards completion time and employment post-submission (Platow 2012). So, here, we look more closely at two different supervisory influences.

5. Supervisor expertise: Researcher degree completion is linked to the supervisor's knowledge and expertise in the research field (Donald et al. 1995; Holdaway et al. 1995). The latter study recommends restricting supervision only to active PhD researchers with expertise in the researcher's area of research. Further, researcher satisfaction and

completion are enhanced when supervisors are senior academics or have greater experience in research supervision (Ives and Rowley 2005).

6. Number of supervisors: Co-supervision is growing as a new form of supervision, enabling supervisors to discuss how to handle emerging issues and researchers to feel better protected (Spooner-Lane et al. 2007). Thus, PhD researchers with more than one supervisor are more satisfied than those with only one (Pearson 1996) (though Heath (2002) found no difference). Further, Sala-Bubaré and Castelló (2016) noted the value of more than one supervisor for researchers who feel isolated or discouraged regarding their doctoral process and outcomes. Still, while co-supervision is perceived positively by supervisors if they meet jointly with the researcher, this process is time consuming and may not be recognized institutionally (Olmos-Lopez and Sunderland 2016). Further, if responsibilities are not clearly articulated, potential problems include, for instance, fragmented supervisory responsibilities (Pole 1998).

PhD researcher–supervisor relations While well researched, this area is paradoxically the most variable given differences in personal histories, preferences, and motivations between individual PhD researchers and supervisors.

7. Availability and meetings: The evidence relates to both availability and frequency of formal meetings. Donald et al. (1995) reported one of the two most important factors in supervision satisfaction was supervisor availability. Zhao et al. (2007) reported availability strongly correlated with researcher satisfaction; a more recent study reported the same (Sverdlik et al. 2018). In a similar vein, Main (2014) reported that the frequency of communication affected program duration and suggested communicating at least semi-monthly. As regards frequency of meetings, another study (Heath 2002) supported this view—though noted that if meetings were at least once a month, satisfaction was not substantially reduced. Further, to enhance researcher progress, completion, and satisfaction, meetings should provide guidance on (a) topic definition, (b) research design and data analysis, and (c) literature to be reviewed.
8. Good working relationship: Lovitts and Nelson (2006) and Ives and Rowley (2005) have linked good progress, completion, and satisfaction with clearly understood expectations. Further, a good PhD researcher–supervisor fit is shown to be associated with positive PhD experience (Golde 2005). More specifically, Hyun et al. (2006)) showed that graduate researchers reporting more functional supervisory relationships are less likely to report mental health issues, whereas those reporting ambiguous expectations were more likely to report such issues. Yet, shared expectations cannot be assumed, so unfortunately, differences may be implicit and lead to misunderstandings (Woolhouse 2002).
9. Feedback: A frequently overlooked aspect of feedback is researcher progress. Zhao et al. (2007) reported satisfaction was correlated with regular and direct reviews of progress and purposefully helping PhD researcher progress in a timely manner. The latter point is supported by Main (2014) who linked good progress and completion with supervisors who explicitly encouraged finishing quickly.

Overall, the evidence suggests that factors such as those above can reduce burnout and lack of completion risk and contribute to more engagement in research, greater productivity and satisfaction, and more timely completion. The contrary will produce the reverse effects, hindering progress and satisfaction. For instance, PhD researchers perceiving a misfit between

themselves and their working environment in terms of problems with supervisors (and the department) may decide to leave (Golde 2005).

Here, we suggest some possible policy recommendations at the personal (PhD researcher and supervisor) levels. Of course, the effects of these policies are cumulative as a constellation of factors interacts in providing a supportive environment for doctoral success. We suggest ensuring these policies are easily accessible online, so they can begin to have effect "on the ground."

→ Ensure policies are consistent in emphasizing the responsibilities of the PhD researcher in advancing through the degree.

- Incorporate this responsibility in all documents, notably, program descriptions, application processes, and codes of practice so that applicants understand the shift in status that is required
- Incorporate PhD researcher agency in different PhD processes, e.g., researcher involvement in the supervisory selection, researcher report on initiatives to grow network in annual report, and researcher participation in program evaluation and improvement.
- Ensure applicants can access and mobilize this information, for instance, through links to program/scholarship application pages, references in the application process, and encouraging questions about it at interview.

→ Ensure policies clearly address requirements of supervisors and are implemented.

- Clarify who can supervise, e.g., degree of experience and expertise required.
- Provide tools to develop needed expertise in supervision and support even experienced supervisors.
- Consider implementing a policy that requires more than one supervisor; include explicit statements of respective supervisor responsibilities.

→ Set out explicit expectations regarding PhD researcher and supervisor responsibilities from the start of the program.

- PhD learning tasks (different from previous learning), beginning with the application process.
- Frequency of meetings.
- Expected PhD timelines; formal benchmarks.
- Supervisory time allocation (number of hours) recognized in workload.

Departmental–faculty–institutional contexts

As noted earlier, we have integrated these contexts since (a) individuals in all three environments have the ability to create policies and (b) institutional change can cascade both up and down. In this section, we attend not just to supporting PhD researchers but also to supervisors. While support of the latter has often been overlooked in doctoral policies, our view is that we need to invest as much policy effort in the support of the supervisor as the researcher and, in

other words, view supervision as a collective responsibility, shared by many other individuals and units besides the named individual (McAlpine 2013). A recent review noted that all relationships and structures involving individuals, resources, and institutions beyond the PhD researcher, e.g., supervision, the department, and financial support opportunities, can directly or indirectly impact progress and completion (Sverdlik et al. 2018).

What promotes satisfaction, retention, and completion

A range of studies suggest that specific departmental through institutional practices can contribute to greater satisfaction, research engagement (Peltonen et al. 2017), and productivity (Scaffidi and Berman 2011) and reduce risk of burnout and lack of completion Jairam and Kahl Jr 2012). We have grouped the evidence as follows: institutional leadership, departmental leadership, and institutional–departmental shared leadership.

Institutional leadership There is minimal research at this level, but what there is provides some policy direction.

10. Institutional structure: Studies have shown that external pressures can lead to a greater institutional focus on reform. For instance, Humphrey et al. (2011) looked at the influence of three UK-required PhD policies within one university on PhD completion within 4 years. The three elements were (a) completing training assessment, (b) completing project approval form, and (c) having team supervision. Having all three experiences, while not the most frequent situation (only 29%), led to the highest probability of completion in 4 years: 70%. Having only two components, a project approval form and team supervision, was the most frequent situation (39%), with the probability of completion dropping to 49%. Similarly, Lee (2013) in an Australian study reported that a change in institutional receipt of government funding to after PhD completion rather than earlier led universities to set clearer milestones for completion, do more careful PhD recruitment of those who would complete, and attend to satisfaction during the program so researchers would not withdraw or transfer. Of course, such initiatives can be undertaken regardless of external funding.

    Yet, as Golde (2005) has noted, doctoral programs are often a hodgepodge of inherited requirements, norms, and traditions. So, institutional investment in doctoral reform requires clarity about the purpose and a clear plan with robust support structures and monitoring (Driver 2006). Such intentional planning often includes a curricular component, collective forms of supervision, and strong intellectual climate and may be structured as a doctoral school (Nyhagen and Baschung 2013).
11. Human and infrastructure resources (access and awareness): access to equipment, work space, and library resources is influential in doctoral satisfaction (Harman 2002). Still, Golde and Dore (2001) reported researcher awareness of institutional resources was not particularly high (except for teaching development), and only two-thirds of those who knew of the resources used them. Nevertheless, resources should include career information and training since researchers have consistently reported both the desire for this support (Golde and Dore 2001; Thiry et al. 2015) and a lack of support and advice from supervisors—perhaps due to a lack of knowledge (Sauermann and Roach 2012). Interestingly, Jackson and Michelson (2015) demonstrated that using career services more than triples the likelihood of employment within 12 months of graduation. Finally,

universities should ensure good PhD counselling services since PhD researchers are high users and such use can reduce emotional and stress-related problems (Hyun et al. 2006)

Departmental leadership At issue here is not just the creation of departmental policies but the extent to which institutional policies are actively and accurately implemented and practiced within departments in disciplinary appropriate ways.

12. Application process: Research on doctoral application processes is virtually absent, though Maher and Barnes (2010) demonstrated that traditional measures are unreliable. Further, we know that one influence on lack of completion can be inappropriate PhD researcher expectations due to poor application processes (Golde 2005). Notably, 80% of researchers have reported the first year overwhelming (Cluett and Skene 2006) and 64% found the transition difficult (West 2012), likely due to poor understanding of expectations. The Maher and Barnes (2010) study demonstrated the value of a more systematic approach to assessment during selection; assessors found the increased rigor provided a more precise measure of previously ill-assessed critical thinking skills leading to more appropriate admissions decisions.
13. Prompt completion: A number of studies have shown departmental leadership and expectations influence completion rates. For instance, completion rates are higher in departments encouraging prompt completion rather than thesis refinement (Main 2014). As well, programs with better supervising and clear requirements reduce lack of completion probabilities (Ehrenberg et al. 2006). Finally, O'Meara et al. (2014) demonstrated that departmental leadership can also influence researcher agency as regards planning for post-PhD careers.
14. Supervisory change: Here, the evidence is negative rather than positive, highlighting the need to reduce and buffer such changes as much as possible. Supervisory change slows progress (Ives and Rowley 2005) yet can be relatively frequent, up to 25% of researchers (Golde and Dore 2001). Unfortunately, researchers experiencing a disruption or change in supervision feel exceptional, isolated, and upset (McAlpine et al. 2012) since they are not aware that such changes are not exceptional and are guided by institutional procedures. Interestingly, these changes are often described by researchers as unexpected or unplanned, suggesting the change could result from supervisor absence, e.g., moving university and taking family leave (Ives and Rowley 2005). Co-supervision would help alleviate such upsets.
15. Departments, research teams, and intellectual/social climate: Researcher program satisfaction has been linked to a collegial climate (autonomy in academic planning and freedom to express opinions) as well as good relations with peers and supervisor (Shin et al. 2018). In other words, engaging intellectually and socially with other researchers promotes a positive experience (Gardner 2010) and greater satisfaction and reduces the risk for study abandonment (Pyhältö et al. 2009; Schmidt and Hansson 2018). Faculty can offer role modelling and intellectual excitement (Gardner 2010) and PhD peers social support. Satisfaction with academic involvement within the program enhances researcher completion (Gittings et al. 2018). But, a perceived mismatch between researcher values and those attributed to the departmental culture may lead researchers to abandon their studies (Gardner 2009). Similarly, researchers in research teams can display higher motivation, experienced support, reduced stress levels and emotional problems, and

enhanced success rates (Jairam and Kahl Jr 2012; Stubb et al. 2011). However, a research team does not necessarily have these effects, if, for instance, the researcher is uncomfortable with the policies, values, and atmosphere within the team (Castelló et al. 2017; Gardner 2009). So, support needs to be conceived broadly, to include informal groups and individual relationships.

More formal support mechanisms can include (inter)departmental research teams and disciplinary networks (e.g., conferences) which also enable sharing of positive experiences, alleviation of negative ones, and enhanced research engagement (Pyhältö et al. 2017). Formal support also includes guides for self-direction by feedback and mentoring or funding information (Gardner 2010; Jairam and Kahl Jr 2012).

Institutional–departmental shared leadership Some issues are best addressed collectively, that is, in institutional ways for consistency and efficiency, and departmental ways to address disciplinary variation.

16. Researcher writing support: Support for publishing would appear essential, with publishing a determining factor in academic advancement (Bergeron et al. 2014), alongside PhD researchers' difficulties in this regard (Aitchison et al. 2012). Such support, for example, workshops, can result in increased confidence, higher levels of productivity, and self-efficacy (Badenhorst et al. 2014). Yet, researchers report struggling to write scientific articles and lack opportunities to learn to write (Sala-Bubaré et al. 2018). This is unfortunate since such activities increase publication rates post-intervention (McGrail et al. 2006) and might also reduce the risk of abandonment (Castelló et al. 2017). While some of these initiatives may best be disciplinary-based, since they incorporate disciplinary approaches and enhance intellectual climate, there is also evidence that cross-disciplinary or disciplinary cluster initiatives are powerful (Sundstrom 2014; Tardy 2005).
17. Supervisor writing support: As for supervisors, providing constructive PhD researcher support can be hindered by perceptions of writing, in that the feedback they provide will be based on their own writing perceptions (González-Ocampo and Castelló 2018). For instance, they may perceive their support through the lens of writing as using a set of technical skills (Lee and Murray 2015; Kamler 2008) rather than as creating knowledge, that is, developing and clarifying research ideas (Paré et al. 2011). The former stance means they may have difficulty understanding the complexity of writing feedback (Paré 2011). Further, writing can generate fear and anxiety in some academics (Lee and Boud 2003). This may be especially true for new supervisors struggling to develop their own writing (Maher and Say 2016). Reports of writing support designed specifically for supervisors are limited, but Lee and Boud (2003) demonstrated that institutionally funded and faculty-situated writing workshops for academics created a shared language for describing the writing process and increased confidence and productivity. As with PhD researchers, disciplinary cluster (Lee and Boud 2003) and cross-disciplinary initiatives (McGrail et al. 2006) are useful.
18. Funding: Having funding has a positive influence on satisfaction (Harman 2002) and completion (Jackson and Michelson 2015). Not surprisingly, lack of funding leads to individuals being less involved in the departmental intellectual climate. Interestingly, the same is true of scholarships, since while they carry recognition value, they do not engage

holders in research or teaching with faculty and researchers. Rather, it is research (RA) and teaching assistant (TA)-ships that draw individuals into the department (Lovitts and Nelson 2006), though TA-ships may take time away from doctoral progress (Gardner 2009). Further, those with RA-ships have the highest likelihood of degree completion compared with other forms of financial support (Ampaw and Jaeger 2012). This evidence again suggests the need for a joint approach with departments having considerable freedom in how institutional financial support for researchers is distributed.

Overall, the above evidence suggests that policies should be directed: (a) institutionally at structures and infrastructure, including career and counselling services; (b) departmentally at prompt completion, supervisor change, research team engagement, and intellectual climate; and (c) collectively at writing support and funding. Such policies will reduce burnout and completion risk and contribute to more engagement in research, greater productivity, more timely completion, and greater satisfaction with doctoral studies (see, e.g., Sala-Bubaré et al. 2018). In contrast, lack of such supportive environments increases dropout risk among doctoral researchers (e.g., Gardner 2010) and has been related to isolation, stress, burnout, and abandonment (Castelló et al. 2017; Peltonen et al. 2017).

Our policy suggestions at the institutional level:

→ Commit institutionally to structural PhD review and reform.

- Agree on a clear purpose for the reform and create an institutional plan for the reform that allows for departmental adjustments within the requirements.
- Consider the value of creating policies that move from single to co-supervision.
- Create efficient monitoring systems that enable proactive management of potential problems.
- Monitor and consult on program/departmental implementation and progress for new policies/practices

→ Ensure university services are well resourced and that information systems enable PhD researchers to easily learn and access them.

- Invest in institutional resources for PhD researchers that are more efficiently offered at the institutional level, e.g., career counselling.
- Offer writing support for PhDs, negotiated jointly with supervisors and departments/faculties.
- Ensure evidence-based training for doctoral supervisors to enable them to understand the core determinants of positive doctoral experience.
- Make sure specific counselling services are prepared to help PhDs.
- Ensure career services adequately address post-PhD careers.

→ Departmentally, review selection processes, supervisory change procedures, and funding "packages"

- Funding: Incorporate departmental responsibilities in scholarship funding; create mixes of TA- and RA-ships, without overloading doctoral researchers with additional tasks, in order

to promote researcher community integration; ensure pay guidelines meet institutional, funding council, and national standards.
- Selection process: Increase rigor in assessing applicants for their preparedness. Admissions should be based on tasks that are similar to the actual work carried out by doctoral researchers and not undergraduate grades. Further, tweak admissions processes to engage applicants to consider career opportunities.
- Supervisory change: Ensure all new PhD researchers know this change is not unusual and understand what the procedure is.
- Research team engagement (when teams exist): Promote researchers' active involvement in research teams and their sense of belonging.

→ Departmentally, review departmental systems to ensure that structures support frequent intellectual and social interaction and support career development

- Commit to evaluating all policies and procedures.
- Commit resources to work-in-progress seminars; research-focus group exchanges; social areas that are central gathering places.
- Commit to research-based development work, including utilizing research-based diagnostic tools to identify both strengths and challenges in doctoral education distribute and utilize the findings in guiding, evaluating, and revising the institutional reform plan.
- Establish graduate follow-up data collection in order to detect employment trajectories.
- Recognize supervision as part of the teaching load in order to allocate the needed time.

→ Departmentally, review support for alternate careers

- Consider engaging alumni with PhDs as potential mentors for junior researchers that aspire to careers outside the academia.
- Consider external internships or placements of some kind.
- Rethink the role of theses (monograph or publications; also types of publications) to ensure researchers have opportunities to become active agents of their future communities (academic and non-academic).

What do we recommend to policymakers?

We undertook this review to generate evidence-based policy implications that might be useful for directors of graduate studies, department heads, and institutional senior management teams. In our view, the starting point for the policy is ensuring that individuals accepted into PhD programs experience satisfaction and progress through their degree. While these researchers will likely focus on the personal relationships they have with those in their program, as Driver (2006) argued, such individual aspects of supervision can best be supported and enhanced not only through policy creation but also through institutional monitoring and oversight of policy implementation. Such oversight

means that administrators have the potential to track implementation with diligence and clarity so that the personal relationship can grow.

Yet undertaking change is not easy. Institutional and local leaders are needed to deal with the range of institutional constraints. Also, affordances need to be used effectively. For instance, providing increased financial and/or human resources can be a motivator. Robust tracking systems are also needed to ensure changes are occurring; in this instance, they should, we believe, include career tracking post-graduation. The results of the monitoring can be disseminated and robust practices rewarded.

We hope that this synthesis will be taken up by stakeholders, policymakers, and also other researchers and that we can collectively become change agents—at least in our own institutions—for educational reform that could better prepare PhD researchers for their futures and supervisors for their important role in the doctoral journey. At the same time, our review highlighted gaps in the research which we hope will be taken up in future research efforts. There is still much we do not know.

Funding information This work was supported by the Erasmus + Programme of the European Union under grant 2017-1-ES01-KA203-038303.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

NB For empirical studies used to draw out policy implications, the following information is provided at the end of the citation.

- *Methods:* Mixed = MX, Quantitative = QN, Qualitative = QL (reviews included here)
- *Discipline*
  - All disciplines = DIS
  - Specific disciplines = STEM (Science, Technology, Engineering and Mathematics), Social Sciences (SS), Humanities (H) and Other (O)
- *Continent:* A = Australasia, E = Europe including UK, NA = North America, I = international

Aitchison, C., Catterall, J., Ross, P., & Burgin, S. (2012). 'Tough love and tears': learning doctoral writing in the sciences. *Higher Education Research and Development, 31*(4), 435–447 **(MX, A, DIS)**.

Ampaw, F., & Jaeger, A. (2012). Completing the three stages of doctoral education: an event history analysis. *Research in Higher Education, 53*, 640–660 **(MX, NA, SS+H)**.

Andres, L., Bengtsen, S., Gallego Castaño, L., Crossouard, B., Keefer, J., & Pyhältö, K. (2015). Drivers and interpretations of doctoral education today: national comparisons. *Frontline Learning Research, 3*(3), 1–18. https://doi.org/10.14786/flr.v3i3.177.

Auriol, L., Schaaper, M., & Felix, B. (2012). Mapping careers and mobility of doctorate holders: Draft guidelines, model questionnaire and indicators – third edition. *OECD Science, Technology and Industry Working Papers, 2012/07*. OECD Publishing. doi: https://doi.org/10.1787/5k4dnq2h4n5c-en.

Badenhorst, C., Moloney, C., Rosales, J., Dyer, J., & Ru, L. (2014). Beyond deficit: graduate student research-writing pedagogies. *Teaching in Higher Education, 20*(1), 1–11. **(QL, NE, H+STEM)**.

Ball, S., Maguire, M., & Braun, A. (2012). *How schools do policy: policy enactments in secondary schools*. London: Routledge.

Barnes, B., Williams, E., & Stassen, M. (2012). Dissecting doctoral advising: a comparison of researchers' experiences across disciplines. *Journal of Further and Higher Education, 36*(3), 309–331 **(QN, NA, SS+STEM+H)**.

Bengtsen, S. (2014). *Review of the handbook literature on doctoral supervision*. Aarhus Denmark: Centre for Teaching Development and Digital Media Aarhus University.

Bergeron, D., Ostroff, C., Schroeder, T., & Block, C. (2014). The dual effects of organizational citizenship behaviour: relationships to research productivity and career outcomes in academe. *Human Performance, 27*(2), 99–128 **(QN, I, SS)**.

Castelló, M., Pardo, M., Sala-Bubaré, A., & Suñe, N. (2017). Why do students consider to drop out of doctoral degrees? Institutional and personal factors. *Higher Education*, 1–16. https://doi.org/10.1007/s10734-016-0106-9 **(MX, E, SS)**.

Cluett, L. and Skene, J. (2006). Improving the postgraduate coursework student experience: barriers and the role of institution. *Proceedings of the AUQF 2006: Quality Outcomes and Diversity, Perth, Australia, 5–7 July 2006*, 62–67. Available from: http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.145.5455&rep=rep1&type=pdf#pa%20ge=76. **(QN, A, SS+STEM+H)**.

Donald, J., Saroyan, A., & Denison, D. B. (1995). Graduate researcher supervision policies and procedures: a case study of issues and factors affecting graduate study. *The Canadian Journal of Higher Education, 25*(3), 71–92 **(MX, NA, SS+H)**.

Driver, J. (2006). SFU reviews graduate supervision. *Gradspeak, 2*, 1), 1–1), 4 **(QL,NA,SS)**.

Ehrenberg, R., Jakubson, G., Groen, J., So, E., & Price, J. (2006). Inside the black box of doctoral education: what program characteristics influence doctoral students' attrition and graduation probabilities*? Educational Evaluation and Policy Analysis, 29*(2), 134–150 **(QN, NA, STEM+SS+H)**.

European University Association (2016). Doctoral education – taking Salzburg forward. Implementation and new challenges. Position paper. Available at: https://eua.eu/downloads/publications/doctoral%20education%20-%20taking%20salzburg%20forward%20implementation%20and%20new%20challenges.pdf.

Forret, M., & Dougherty, T. (2004). Networking behaviors and career outcomes: differences for men and women? *Journal of Organizational Behaviour, 25*(3), 419–437 **(QN, NA, SS+STEM)**.

Gardner, S. (2010). Contrasting the socialization experiences of doctoral researchers in high-and low-completing departments: a qualitative analysis of disciplinary contexts at one institution. *The Journal of Higher Education, 81*(1), 61–81 **(QL, NA, SS+STEM)**.

Gardner, S. (2009). Researcher and faculty attributions of attrition in high and low-completing doctoral programs. *Higher Education, 58*, 97–112 **(QL, NA, SS+STEM)**.

Gittings, G., Bergman, M., Shuck, B., & Rose, K. (2018). The impact of student attributes and program characteristics on doctoral degree completion. *New Horizons in Adult Education and Human Resource Development, 30*(3), 3–22 **(QN, NA, DIS)**.

Golde, C. (2005). The role of the department and discipline in doctoral researcher attrition: lessons from four departments. *Journal of Higher Education, 76*(6), 669–700 **(QL, NA, SS+STEM)**.

Golde, C. (2001). *Overview of doctoral education researchers and reports: 1990-present*. Stanford, US: Carnegie Foundation for the Advancement of Teaching.

Golde, C., & Dore, T. (2001). *At cross purposes: what the experiences of today's doctoral researchers reveal about doctoral education*. Philadelphia. **(QN, NA, SS+STEM+H)**.

Goller, M., & Harteis, M. (2013). Employing agency in academic settings: doctoral students shaping their own experiences. In C. Harteis et al. (Eds.), *Discourses on professional learning: on the boundary between learning and working* (pp. 189–210). Dordrecht: Springer.

González-Ocampo, G., & Castelló, M. (2018). Writing in doctoral programs: examining supervisors' perspectives. *Higher Education, 76*(3), 387–401 **(MX, E, SS+H)**.

Grant, M., & Booth, A. (2009). A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Information Library Journal, 26*(2), 91–108.

Hancock, S., Hughes, G., & Walsh, E. (2015). Purist or pragmatist? UK doctoral scientists' moral positions on the knowledge economy. *Studies in Higher Education, 42*(7), 1244–1258.

Harman, G. (2002). Producing PhD graduates in Australia for the knowledge economy. *Higher Education Research and Development, 21*(2), 179–190 **(MX, A, SS)**.

Heath, T. (2002). A quantitative analysis of PhD researchers' views of supervision. *Higher Education Research & Development*, *21*(1), 41–53. **(QN, A, SS)**.

Holbrook, A., Shaw, K., Scevak, J., Bourke, S., Cantwell, R., & Budd, J. (2014). PhD candidate expectations: exploring mismatch with experience. *International Journal of Doctoral Studies, 9*, 329–346 **(MX, A, SS+H)**.

Holdaway, E., Delbois, C., & Winchester, I. (1995). Supervision of graduate researchers. *The Canadian Journal of Higher Education, 25*, 3), 1–3),29 **(QN, NA, SS+H)**.

Humphrey, R., Marshall, N., & Leonardo, L. (2011). The impact of research training and research codes of practice on submission of doctoral degrees: an exploratory cohort study. *Higher Education Quarterly, 66*(1), 47–64 **(QN, E, SS+H)**.

Hyun, J., Quinn, B., Madon, T., & Lustig, S. (2006). Graduate researchers mental health: needs assessment and utilization of counselling services. *Journal of College Researcher Development, 47*(3), 247–266 **(QN, NA, SS+STEM+H)**.

Ives, G., & Rowley, G. (2005). Supervisor selection or allocation and continuity of supervision: PhD researcher' progress and outcomes. *Studies in Higher Education, 30*(5), 535–555 **(QL, A, SS+STEM)**.

Kamler, B. (2008). Rethinking doctoral publication practices: writing from and beyond the thesis. *Studies in Higher Education, 33*(3), 283–294 **(QL, A, SS+H)**.

Jackson, D., & Michelson, G. (2015). Factors influencing the employment of Australian PhD graduates. *Studies in Higher Education, 40*(9), 1660–1678 **(QN, A, SS+H)**.

Jairam, D., & Kahl Jr., D. (2012). Navigating the doctoral experience: the role of social support in successful degree completion. *International Journal of Doctoral Studies, 7*, 311–329 **(QL, NA, SS+STEM+H)**.

John, T., & Denicolo, P. (2013). Doctoral education: a review of the literature monitoring the doctoral researcher experience in selected OECD countries (mainly UK). Springer Science Reviews, One, 41–49.

Lee, A. (2013). New development: are our doctoral programmes doing what we think they are? *Public Money and Management, 33*(2), 119–122 **(QL, E, SS+H)**.

Lee, A., & Boud, D. (2003). Writing groups, change and academic identity: research development as local practice. *Studies in Higher Education, 28*(2), 187–200 **(QL, A, SS+H)**.

Lee, A., & Murray, R. (2015). Supervising writing: helping postgraduate researchers develop as researchers. *Innovations in Education and Teaching International, 52*(5), 558–570 **(MX, E, STEM+H)**.

Leonard, D., Metcalfe, J., Becker, R., & Evans, J. (2006). *Review of literature on the impact of working context and support on the postgraduate research researcher learning experience*. London: Higher Education Academy.

Lovitts, B., & Nelson, C. (2006). The hidden crisis in graduate education: attrition from PhD programs. *Academe, 86*(6), 44–50. **(QN, NA, SS+H)**.

Maher, M., & Barnes, B. (2010). Assessing doctoral applicants' readiness for doctoral-level work. *Assessment today, 22*(5), 8–10 **(MX, NA, SS+STEM+H)**.

Maher, M., & Say, B. (2016). Doctoral supervisors as learners and teachers of disciplinary writing. In C. Guerin & C. Badenhorst (Eds.), *Post/graduate writing pedagogies and research literacies in the 21st Century*. London: Emerald, Ch. 15, 277–294. **(QL, NA, SS+STEM)**.

Main, J. (2014). Gender homophily, PhD completion, and time to degree in the humanities and humanistic social sciences. *The Review of Higher Education, 37*(3), 349–375 **(QN, NA, SS+H)**.

Mangematin, V. (2000). PhD job market: professional trajectories and incentives during the PhD. *Research Policy, 29*(6), 741–756.

McAlpine, L. (2017). Building on success? Future challenges for doctoral education globally. *Studies in Graduate and Postdoctoral Education., 8*(2), 66–77.

McAlpine, L. (2013). Doctoral supervision: not an individual but a collective institutional responsibility. *Infanci y Aprendizaje, 36*(3), 259–280 **(MX, E, SS+H)**.

McAlpine, L., & Amundsen, C. (2018). *Identity-trajectories: ways of understanding post-PhD career choices*. Basingstoke: Palgrave MacMillan. **(QL, NE & E, SS + STEM)**.

McAlpine, L., & Amundsen, C. (2016). *Post-PhD career trajectories: intentions, decision-making and life aspirations*. Basingstoke: Palgrave Pivot. **(QL, NE & E, SS + STEM)**.

McAlpine, L., Paulson, J., Gonsalves, A., & Jazvac-Martek, M. (2012). 'Untold' doctoral stories in the social sciences: can we move beyond cultural narratives of neglect? *Higher Education Research and Development, 31*(4), 511–523 **(QL, I, SS+H)**.

McAlpine, L., & Norton, J. (2006). Reframing our approach to doctoral programs: a learning perspective. *Higher Education Research and Development, 25*(1), 3–17 **(QL, NA, SS)**.

McGrail, M., Rickard, C., & Jones, R. (2006). Publish or perish: a systematic review of interventions to increase academic publication rates. *Higher Education Research and Development, 25*(1), 19–35 **(QL, A, SS)**.

Nyhagen, G., & Baschung, L. (2013). New organizational structures and the transformation of academic work. *Higher Education, 4*, 409–442 **(QL, E, SS)**.

Olmos-Lopez, P., & Sunderland, J. (2016). Doctoral supervisors' and students' responses to co-supervision. *Journal of Further and Higher Education, 41*(6), 727–740 **(MX, E, SS + H)**.

O'Meara, K., Jaeger, A., Eliason, J., Grantham, A., Cowdery, K., Mitchall, A., & Zhang, K. (2014). By design: how departments influence graduate researcher agency in career advancement. *International Journal of Doctoral Studies, 9*, 155–179 **(MX, NA, SS + H)**.

OECD. (2016). *Education at a Glance 2016: OECD indicators*. Paris: OECD Publishing. https://www.oecd-ilibrary.org/education/education-at-a-glance-2016_eag-2016-en.

Paré, A. (2011). Speaking of writing: Supervisory feedback and the dissertation. In L. McAlpine & C. Amundsen (Eds.), *Doctoral education: research-based strategies for doctoral researchers, supervisors and administrators* (pp. 59–74). Dordrecht: Springer **(MX, A, SS)**.

Paré, A., Starke-Meyerring, D., & McAlpine, L. (2011). Knowledge and identity work in the supervision of doctoral researcher writing: shaping rhetorical subjects. In D. Starke-Meyerring, A. Paré, N. Artemeva, M. Horne, & L. Yousoubova (Eds.), *Writing in knowledge societies* (pp. 215–236). Fort Collins: The WAC Clearinghouse and Parlor Press **(QL, NA, SS+STEM)**.

Pearson, M. (1996). Professionalizing PhD education to enhance the quality of the researcher experience. *Higher Education, 32*, 303–320 **(MX, A, SS+STEM+H)**.

Peltonen, J., Veikkaila, J., Haverinen, K., Rautio, P., & Pyhältö, K. (2017). Interrelations between supervisory researcher community support experiences and risk factors among doctoral students. *International Journal of Doctoral Studies, 12*(1), 157–173 **(QN, E, SS+STEM+H)**.

Pilbeam, C., & Denyer, D. (2009). Lone scholar or community member? The role of student networks in education in a UK management school. *Studies in Higher Education, 34*(3), 301–318 **(QN, E, SS)**.

Platow, M. (2012). PhD experience and subsequent outcomes: a look at self-perceptions of acquired graduate attributes and supervisor support. *Studies in Higher Education, 37*(1), 103–118 **(QN, A, SS+STEM)**.

Pole, C. (1998). Joint supervision and the PhD: Safety net or panacea? *Assessment and Evaluation in Higher Education, 23*(3), 259–271.

Pyhältö, K., & Keskinen, J. (2012). Doctoral students' sense of relational agency in their scholarly communities. *International Journal of Higher Education, 1*(2), 136–149. https://doi.org/10.5430/ijhe.v1n2p136 **(QN, E, SS+STEM+H)**.

Pyhältö, K., McAlpine, L., Peltonen, J., & Castello, M., (2017). How does social support contribute to engaging post-PhD experience? European Journal of Higher Education. 17 (4), 373–387**.** https://doi.org/10.1080/21568235.2017.1348239. **(QN, E, SS+STEM)**.

Pyhältö, K., Stubb, J., & Lonka, K. (2009). Developing scholarly communities as learning environments for doctoral students. *International Journal for Academic Development, 14*, 221–232 **(MX, E, SS+H)**.

Pyhältö, K., Vekkaila, J., & Keskinen, J. (2015). Fit matters in the supervisory relationship: doctoral students' and supervisors' perceptions about supervisory activities. *Innovations in Education and Teaching International, 52*(1), 4–16 **(QN, E, SS)**.

Sala-Bubaré, A., & Castelló, M. (2016). Exploring the relationship between doctoral students' experiences and research community positioning. *Studies in Continuing Education*, 1–19. https://doi.org/10.1080/0158037X.2016.1216832 **(QL, E, SS)**.

Sala-Bubaré, A., Peltonen, J., Pyhältö, K., & Castelló, M. (2018). Doctoral students' research writing perceptions profiles: a cross-national study. *International Journal of Doctoral Studies, 13*, 327–345 **(MX,E,SS+STEM+H)**.

Sauermann, H., & Roach, M. (2012). Science PhD career preferences: levels, changes and advisor encouragement. *PLoS One, 7*(5), e36307 **(QN, NA, SS)**.

Scaffidi, A., & Berman, J. (2011). A positive postdoctoral experience is related to quality supervision and career mentoring, collaborations, networking and a nurturing research environment. *Higher Education, 62*, 685–698 **(QN, A, SS+STEM)**.

Schmidt, M., & Hansson, E. (2018). Doctoral students' well-being: a literature review. *International Journal of Qualitative Studies on Health and Well-Being, 13*(1). https://doi.org/10.1080/17482631.2018.1508171.

Shin, J., Kim, S., Kim, E., & Lim, H. (2018). Doctoral students' satisfaction in a research-focused Korean university: socio-environmental and motivational factors. *Asia Pacific Education Review, 19*, 159–168 **(QN, A, DIS)**.

Spooner-Lane, R., Henderson, D., Price, R., & Hill, G. (2007). Practice to theory: co-supervision stories. *The International Journal of Research Supervision, 1*(1), 39–51 **(QL, A, SS+H)**.

Stubb, J., Pyhältö, K., & Lonka, K. (2011). Balancing between inspiration and exhaustion? Ph.D. students' experienced socio-psychological well-being. *Studies in Continuing Education, 33*(1), 33–50. https://doi.org/10.1080/0158037X.2010.515572 **(MX, E, STEM)**.

Sundstrom, C. J. (2014). The graduate writing program at the University of Kansas: an inter-disciplinary, rhetorical genre-based approach to developing professional identities. In Composition forum (Vol. 29). Association of Teachers of Advanced Composition https://files.eric.ed.gov/fulltext/EJ1022020.pdf **(MX, NA, SS+STEM)**.

Sverdlik, A., Hall, N., McAlpine, L., & Hubbard, K. (2018). The PhD experience: a review of the factors influencing doctoral students' completion, achievement, and well-being. *International Journal of Doctoral Studies, 13*, 361–388 **(QN, QL & M, I, ALL)**.

Tardy, C. M. (2005). Expressions of disciplinarity and individuality in a multimodal genre. *Computers and Composition, 22*(3), 319–336 **(QL, NA, SS+STEM+H)**.

Teelken, C. (2012). Compliance or pragmatism: how do academics deal with managerialism in higher education? A comparative study in three countries. *Studies in Higher Education, 37*, 271–290.

Thiry, H., Laursen, S., & Loshbaugh, H. (2015). "How do I get from here to there?" An examination of PhD science researchers' career preparation and decision making. *International Journal of Doctoral Studies, 10*, 237–256 **(QL, NA, SS+H)**.

University of Reading. (2013). *Monitoring and assessing the progress of doctoral researchers:* good practice guide. Downloaded 21.10.2018 https://www.reading.ac.uk/web/files/graduateschool/pgrmonitoringguide.pdf.

Vanstone, M., Hibbert, K., Kinsella, E., McKenzie, P., Pitman, A., & Lingard, L. (2013). Interdisciplinary doctoral research supervision: a scoping review. *Canadian Journal of Higher Education, 43*(2), 42–67.

Vos, L. (2013). Dissertation study at the postgraduate level: a review of the literature. York: Higher Education Academy.

West, K. (2012). Formative evaluation of the transition to postgraduate study for counselling and psychotherapy training: students' perceptions of assignments and academic writing. *Counselling and Psychotherapy Research: Linking Research with Practice, 12*(2), 128–135 **(MX, E, SS+STEM)**.

Woolhouse, M. (2002). Supervising dissertation projects: expectations of supervisors and students. *Innovations in Education and Teaching International, 39*(2), 137–144 **(QL, E, SS+H)**.

Zhao, C., Golde, C., & McCormick, A. (2007). More than a signature: how advisor choice and advisor behaviour affect researcher satisfaction. *Journal of Further and Higher Education, 31*(3), 263–281 **(QN, NA, SS+H)**.

Affiliations

Lynn McAlpine[1] · Montserrat Castello[2] · Kirsi Pyhaltö[3]

[1] Department of Education, University of Oxford, 15 Norham Gardens, Oxford 0X2 6PT, UK

[2] Department of Psychology, Universitat Ramon Llull, Avda. Sant Gervasi, 47, 08022 Barcelona, Spain

[3] Center for University Teaching and Learning, Faculty of Educational Sciences, University of Helsinki, P.O. Box 9, 00014 Helsinki, Finland